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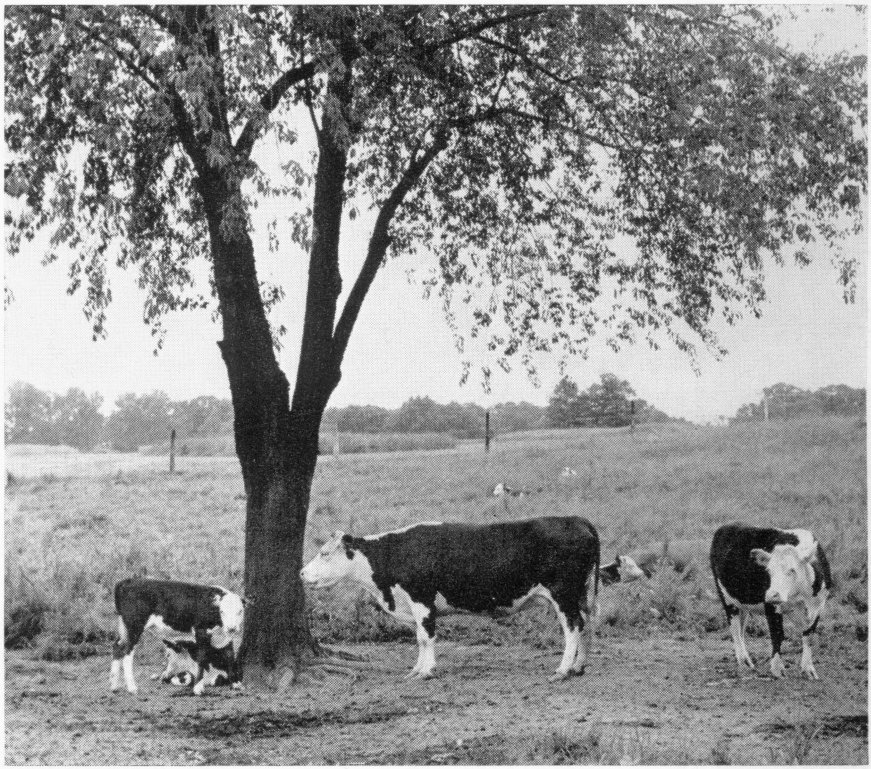
Economics of Improving Hill Land for Beef Production

R. H. BLOSSER



OHIO AGRICULTURAL EXPERIMENT STATION
Wooster, Ohio

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ECONOMICS OF IMPROVING HILL LAND FOR BEEF PRODUCTION

R. H. BLOSSER[1]

SUMMARY

Income figures (estimates) based on farm budgeting procedures show that with top grade management beef cattle can pay for a major soil improvement program in southeastern Ohio. This conclusion is based on raising a beef breeding herd on 500 acres of hill land, and selling the young cattle at slaughter weights averaging 850 pounds. Top grade management included above average quality livestock, a minimum investment in machinery, fences and buildings, efficient use of labor, a well balanced pasture program, high crop yields and a 93 percent calf crop sold.

Crop production, livestock numbers, capital requirements, labor needs, receipts, expenses and net income were determined by farm budgeting procedures so that all factors could be held constant except the ones under consideration at a particular time. In this way, changes in income could be attributed solely to better soil management.

Calculations were made for nine consecutive years which should reflect most of the increases in crop yields. Yields before and after establishing the soil improvement program were based on the best experimental data and farm experience available. Farm product prices and production costs used in calculating income were averages for the five year period 1951-55.

Soils studied were Muskingum and associated types which cover about one-half of southeastern Ohio. Soil improvement programs on this type of land usually require contour strip cropping if corn is to be raised, and heavy applications of lime and fertilizer on both the cropland and permanent pasture.

With top grade management, a soil improvement program will increase profits after the initial expenditures for lime and fertilizer have been recovered. But until the fifth year, net cash income will be less than before any changes were made. About seven years will be needed to increase the hourly returns to labor.. Under average management, more time would be required.

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[1]Valuable suggestions for preparing this bulletin were made by Mervin G. Smith, J. H. Sitterley, and E. T. Shaudys of the Department of Agricultural Economics and Rural Sociology.

Length of time needed to finance a soil improvement program out of cash receipts and increases in inventory will depend upon the price of beef and the amount produced. If annual production of beef averaged 195 pounds per acre of cropland and improved permanent pasture used for the beef enterprise, slaughter cattle would have to sell for about $23.00 net per hundred pounds over a 10 year period to pay all additional costs. A price of $24.00 would reduce the time needed to about seven years. A price of less than $21.00 would not pay all costs of establishing the program.

If production of beef were only 150 pounds per acre, the price of slaughter cattle would have to average about $25.50 per hundredweight after deducting hauling charges to pay all costs in a 10 year period. A price of $28.00 would be needed to reduce time requirements to six years. With this level of beef production, additional costs could not be paid out of farm earnings if slaughter cattle sold for less than $23.00. These calculations are based on paying family labor $.75 an hour plus the use of a house and charging four percent interest on all capital used.

If any capital were borrowed, additional income would be needed to make repayments on principal. Since lending agencies usually require some repayment on loans each year, most beef farmers would have considerable difficulty borrowing any sizable amount of money during the early stages of a major soil improvement program.

How then could such a program be financed? A small proportion of farmers might use savings on which no interest had to be paid. An off-farm job might supply added income for the first few years of the program. Also, the level of family living might be reduced somewhat until additional returns are greater than additional costs.

PURPOSE OF STUDY

Many studies show that soil improvement programs increase farm profits after they have been in operation for a period of time. But few studies show how such programs affect farm income during the period of establishment.

The purpose of this study was to determine whether beef cattle alone would furnish sufficient income to finance a major soil improvement program on hill land. This type of farming was selected to answer questions about the possibility of buying low priced land and improving it for the production of beef.[2]

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[2]Costs and returns when dairy cows are used are given in the following publication: Blosser, R. H., Economics of Building Up a Run Down Dairy Farm in Southeastern Ohio. Ohio Agricultural Experiment Station, Research Bulletin 784. December, 1956.

Major soil improvement programs often require several years to pay for themselves, if customary rates are charged for all labor and capital used. On many farms, costs of liming cropland may not be fully recovered until a meadow crop has been produced and marketed through livestock. Several years usually are required before benefits of permanent pasture improvement are fully realized.. Better meadows cannot increase corn yields until residues are plowed under.

HOW STUDY WAS MADE

Income figures from privately owned farms are rarely suitable for a study of this type because few farmers keep other practices the same while adopting a soil improvement program. In recent years, farmers have adopted many practices that have no relationship to improving soil productivity. A few examples include the use of better varieties and more effective control of weeds, insects and diseases. Unless all other factors remain the same over a period of time, changes in income on actual farms cannot be attributed solely to better soil management.

In this study, receipts, expenses and net income were determined by farm budgeting procedures.[3] This method produced income figures that changed only as a result of the soil improvement program.

Detailed calculations included crop production, livestock numbers, capital requirements, labor needs, receipts, expenses and net income. Each item was calculated for nine consecutive years. Different farming situations were considered in evaluating the soil improvement program. However, a detailed discussion will cover only a brood cow herd receiving top grade care and management. Other farming situations will be used only to bring out additional economic considerations. Minor details will be omitted to simplify the study as much as possible.

SOURCE OF CROP DATA

Land Use—Acreages used in calculating crop production are shown in table 1. Distribution of crops was determined from census data, soils maps and a recent beef study.[4] Although the percentage of land in various crops is about the same as found on the average hill

[3]Farm budgeting is a method used to determine future receipts, expenses and net income from a given set of input-output relationships. In this procedure results of specific changes can be studied because all factors can be held constant except those under consideration.

[4]Shaudys, E. T. and J. H. Sitterley, Costs of Producing Beef in Southeastern Ohio, 1954. Ohio Agricultural Experiment Station Research Circular 45, April, 1957.

TABLE 1.—Land Use for 500 Acre Beef Farm

Land Use	Acres	Percent
Corn	22	4.4
Wheat	22	4.4
Oats	13	2.6
Meadow	75	15.0
Rotated Land	132	26.4
Permanent Pasture		
Suitable for Improvement	120	24.0
Unsuitable for Improvement	48	9.6
Woods	150	30.0
Miscellaneous	50	10.0
Total	500	100.0

farm in southeastern Ohio, total farm area is considerably greater.[5] Census data for this area showed that 500 acres would make about four average size farms. But calculations indicated that at least 500 acres of land would be needed if a beef enterprise is used to employ a farm family full time. In making these calculations, the following assumptions were made: available farm labor would amount to almost 3100 hours a year; cropland and permanent pasture would be limed and fertilized according to soil needs; and young stock would be fed to average slaughter weights of 850 pounds.

Distribution of crops for the entire farm was as follows: grain and hay about 26 percent, permanent pasture 34 percent, woods and miscellaneous 40 percent. No reduction in the acreage of grain crops was assumed to be necessary for soil improvement purposes, if contour strip cropping were used on the steep slopes. Land use capability maps for southeastern Ohio show that about 70 percent of the land classified as permanent pasture can be limed, fertilized and mowed with modern farm machinery. But the remaining 30 percent is unsuitable for improvement because of steep slopes and brushy growth.

[5]An attempt was made to use the actual acreages in crops on a specific farm. Soils maps and land use data were checked in six Soil Conservation District offices to locate a satisfactory farm. This idea was abandoned for several reasons. Many farms were not mapped so that soil type and slope of land could be determined. Most farms that had been mapped were too small for this study. Therefore, a farm situation was determined so that the land use pattern would be typical of the way Muskingum and associated soils are farmed in southeastern Ohio.

Grain and hay production was calculated from three different crop rotations. Corn, wheat and one year of meadow were assumed to be used on 24 acres of bottom land. Corn, wheat and two years of meadow supplemented with contour strips were planned for 56 acres of hill land. Oats and three years of meadow were assumed to be planted on 52 acres of stripped hill land which was considered too steep for corn. Strips for this rotation could be wider than the ones used on corn land. Oats were used only to keep wheat acreages within current allotments. For southeastern Ohio wheat is usually more profitable than oats. By using three different rotations grain production could be maximized while crop yields were being improved.[6]

Crop Yields—Total crop production on the rotated land was calculated from the yields in table 2.[7] These yields are averages for Muskingum and associated soils which extend over about one-half of southeastern Ohio. Muskingum soils are unglaciated and have developed from sandstone and shale. They are too acid to grow alfalfa unless several tons of lime per acre have been applied recently. Muskingum soils erode easily because of steep slopes which range from 10 to 30 percent. Soil surveys show that in most areas more than half of the original topsoil has been lost from fields used for cultivated crops. Most of this loss is due to sheet erosion, but a few shallow gullies exist on the steeper slopes.

Estimated crop yields before the improvement program was started were based on using no contour strips and fertilizer applications of only 200 pounds per acre of 3-12-12 analysis on corn and small grain. Meadows received no fertilizer. Applications of lime averaged only one-half ton every four years. Under these conditions, timothy would normally be the principal meadow crop.

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[6]These rotations were based on soil capability classes used by personnel of Soil Conservation Districts to develop cropping programs to control erosion and improve soil productivity.

[7]These yields are estimates made by the author and Extension Agronomists at Ohio State University. Estimates were based largely on the yields given in table 3, page 9 of the following publication: Blosser, R. H., Economics of Soil Conserving Practices on Muskingum and Associated Soils in Ohio. Ohio Agricultural Experiment Station Research Bulletin 746, August, 1954. Estimated yields were used because no detailed experimental data were available for the improvement period discussed in this study. This includes yields on plots and privately owned land on which everything was held constant except the soil improvement program.

TABLE 2.—Yields Used in Calculating Crop Production for 500 Acre Beef Farm*

Crop	Before Improvement Program	During Improvement Program		
		First Rotation Period	Second Rotation Period	Third Rotation Period
Corn, bu.	45	55	62	65
Wheat, bu.	20	23	25	26
Oats, bu.	30	35	38	40
Hay, first cutting, tons	1.0†	1.0†	1.4‡	1.8§
Hay, second cutting, tons	----	.5†	.7‡	1.0§

*Yields for the nine southeastern Ohio counties where Muskingum soils predominate were as follows for the ten year period 1947-56: corn 49 bushels, oats 34 bushels, wheat 22 bushels, and hay 1.4 tons per acre.

†Timothy with some red clover.

‡Red clover and timothy with some alfalfa.

§Alfalfa, clover and timothy.

Yields for the 24 acres of bottom land were assumed to be the same as produced on the hill areas for two reasons. High water occasionally causes some crop losses along the small streams. Also, the bottom soils had a smaller percentage of meadows in the rotation than the hill land.

Crop yields under the improvement program were based on the use of contour strip cropping and more liberal applications of fertilizer and lime. Corn, wheat and oats were assumed to be fertilized with 250 pounds per acre of 5-20-20. First year meadows were top dressed with 200 pounds per acre of 0-20-20 fertilizer after making the first crop of hay. Lime was assumed to be applied according to needs as shown by tests for Muskingum soils. Specific amounts included an initial application of four tons per acre of agricultural ground limestone; two tons for the second rotation; and one ton each rotation thereafter for maintenance.

Rotation pasture yields were based on the type and estimated amount of hay that could have been harvested. Permanent pasture yields were determined from experimental data.[8] Permanent pasture yields before the improvement program was started were based on using no fertilizer and lime. Yields of permanent pasture during the improvement period were based on using three and one-half tons per

[8]Rotation and permanent pasture yields were taken from pages 6 and 7 of the following publication: Dodd, D. R., Good Pasture, Ohio Extension Bulletin No. 345. August, 1954.

acre of agricultural ground limestone followed by one ton every four years, and 425 pounds per acre of 0-20-20 fertilizer every three years, and one mowing each year to control weeds and brush.

Total Crop Production—Annual production of grain and hay is shown in table 3. Grain production in the ninth year of the program was calculated to be about 40 percent higher than the amount produced before any soil improvement was made. The amount of hay harvested was almost doubled because of the change from timothy and a small amount of clover to a mixture of alfalfa, clover and timothy. Since acreages remained constant all production increases were due to higher yields per acre.

Before improving the soil, hay production was figured only from a first cutting on 75 acres. But during the period of improvement, total hay production was calculated from a first cutting on 75 acres and a second cutting on 14 acres grown between corn strips. This left 61 acres for pasturing after making the first crop of hay. A second cutting of hay was assumed to be made instead of pasturing between corn strips to eliminate the need for constructing temporary fences and providing watering facilities for livestock. Meadow strips next to wheat could be pastured after the first cutting of hay without constructing temporary fences.

Yields of permanent pasture were approximately doubled during the period studied. Before improvement, about four acres of permanent pasture were considered necessary to support one animal unit of livestock. But after improvement only two acres would be required when

TABLE 3.—Calculated Crop Production for 500 Acre Beef Farm

Year	Corn	Wheat	Oats	Hay
	Bushels	Bushels	Bushels	Tons
0*	990	440	390	75
1†	1210	506	455	82
2	1210	506	455	99
3	1210	506	455	113
4	1266	522	455	119
5	1364	550	494	122
6	1364	550	494	133
7	1388	558	494	144
8	1388	558	494	149
9	1430	572	520	149

*Before soil improvement program was established.
†Years 1-9 represent period of improvement.

production reached the maximum. These carrying capacities apply only during May and June, the period when permanent pasture yields are highest. To provide a well balanced pasture program, throughout the summer months, all meadows were assumed to be pastured after making the first crop of hay, except 14 acres located between corn strips.

Calculations were made only for a nine year period to simplify the study as much as possible. Agronomists at Ohio State University think this is long enough to practically maximize meadow and permanent pasture yields. But grain production might be expected to increase slightly beyond the ninth year. However, one or two more bushels of grain per acre would not change conclusions significantly, especially when the principal crop is forage.

AMOUNT OF LIVESTOCK FARM WOULD SUPPORT

The amount of livestock that could be kept is shown in table 4. In calculating livestock numbers, no feed was assumed to be purchased except protein supplement. Feed requirements for each animal were based on Ohio livestock feeding standards.[9]

The amount of hay and pasture the farm would produce was used to determine the number of beef cows, replacements and feeder cattle that could be kept. No other forage consuming livestock was considered. Hogs were used to consume all of the corn not needed by the beef enterprise. This procedure was based on the assumption that net income would be higher if grain were fed to hogs instead of sold. Also, hogs would require less capital and involve less risk than purchasing feeder cattle to consume the surplus grain. All wheat was assumed to be sold except a small amount fed to hogs. Oats were fed.

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[9]Cow and calf to weaning were allowed 1.8 tons of legume hay, .5 tons of oats and wheat straw and 3 bushels of grain. Feeder calves from weaning to market were allowed .5 tons of legume hay, 35 bushels of grain and 300 pounds of protein supplement. Replacement heifers from calves to freshening were allowed 2.7 tons of legume hay, 5 bushels of grain and 200 pounds of protein supplement. Market hogs (including the sow's share) weighing 200 pounds were allowed 14 bushels of corn, 2.5 bushels of wheat and 80 pounds of protein supplement. These feed requirements were taken from pages 21-25 and 12-15 of the following publication: Sitterley, J. H., Rates of Feed Consumption by Livestock. Department of Agricultural Economics and Rural Sociology, Ohio State University, Extension Bulletin No. 308, Revised 1955.

TABLE 4.—Calculated Livestock Numbers for 500 Acre Beef Farm*

Year	Beef cows	Feeder cattle†	Market hogs
0‡	32	24	15
1§	29	18	48
2	33	21	39
3	37	24	31
4	41	27	26
5	45	32	21
6	49	36	11
7	52	39	0
8	54	42	0
9	55	43	0

*Two bulls were figured to be kept each year.

†Based on using July 1 for beginning and closing inventories; market weights per animal were assumed to average 850 pounds.

‡Before soil improvement program was established.

§Years 1-9 represent period of improvement.

Calculations show that beef cows could be increased about 70 percent from the additional feed produced by the soil improvement program. Small amounts of corn should be available each year for fattening hogs until the seventh year of the program. But from then on, the beef herd would require all of the corn the farm would produce.

Cow numbers were reduced slightly during the first year of the program to provide feed for replacements to build a larger herd. Feeder cattle numbers also were reduced for the first two years and more young stock was held for breeding purposes. Feeder cattle numbers were based on a 93 percent calf crop raised to marketable weights[10] and 15 percent annual replacement of old cows.

[10]This figure means that over a period of time a 100 cow herd at breeding time will produce annually 93 animals that can be either marketed as slaughter cattle or cull cows. This takes into consideration the fact that slightly more than one calf crop can be produced in any one year. Under average management the number of market animals produced per cow would not be quite as high as assumed in this study.

CAPITAL REQUIREMENTS, RECEIPTS, EXPENSES AND NET INCOME

Capital Needed—Estimated capital requirements in table 5 are based on 1951-55 prices. Annual investment in land was calculated in the following way. For the first year, land was valued at local real estate prices. But for succeeding years, land values were increased by an amount equal to the cost of lime used in excess of maintenance applications. This figure was assumed to be the same as the replacement cost of the lime remaining in the soil. Inventory value of land, excluding $1000 worth of fence, was thereby increased from $14,000 to $18,800.

Below average land might be purchased for less than the assumed values in this study. However, clearing operations might raise the final cost above the valuations used. Below average farms often have large amounts of brush and small trees that must be removed to make the land suitable for cultivated crops and permanent pasture.

Buildings were inventoried at $10,000 at the beginning of the program. Depreciation was estimated to be $200 annually. This method of appraisal reduced the valuation to $8400 by the ninth year. Principal buildings included a house needing only minor repairs, and two large barns in fair condition. The assumption was made that no more buildings would be needed as a result of the soil improvement program. Usually 500 acres of land will have more buildings than needed for beef

TABLE 5.—Estimated Capital Requirements for 500 Acre Beef Farm

Year	Land and fences	Buildings	Machinery	Livestock	Total
0*	$15000	$10000	$5500	$ 9100	$39600
1†	15000	10000	5500	9100	39600
2	16000	9800	5500	10200	41500
3	17000	9600	5500	11300	43400
4	18000	9400	5500	12200	45100
5	19000	9200	5500	13500	47200
6	19200	9000	5500	14400	48100
7	19400	8800	5500	15100	48800
8	19600	8600	5500	15600	49300
9	19800	8400	5500	15700	49400

*Before soil improvement program was established.
†Years 1-9 represent period of improvement.

production, especially if several farms have been combined recently. Therefore, some buildings may need to be sold to reduce the valuation to the amount used. More buildings would raise capital investments, but a second house might increase income in the form of rent. If a barn were needed, a pole type structure could be built at a nominal cost by using timber produced on the farm. Better than average buildings and more than the needed number could increase investments several thousand dollars. Higher building investments would produce a smaller net income than shown in this study.

Fences were valued at $1000 throughout the period studied. New construction and repairs were assumed to offset annual depreciation. To keep investment this low, barbed wire and farm grown posts would have to be used in most cases. Woven wire fences would about double this valuation.

Machinery investment was kept down to $5500 by assuming it would be about half worn out, and some exchange of work and equipment would be made with neighbors. Annual investment was held the same by assuming that some better pieces of machinery would be bought occasionally. A full line of almost new equipment would more than double machinery values used.

Livestock was increased in value from $9100 to $15,700 because of greater numbers. Total capital required was increased from $39,600 to $49,400. Land values were increased $4800 because of cash expenditures for lime. Livestock values were increased $6600 because of inventory increases.

Receipts—Estimated cash receipts before and after the soil improvement program was established are shown in table 6. Receipts from all sources increased from $7000 to $11,036, or about 60 percent. Receipts from cull cows and slaughter cattle increased about 75 percent by the time the ninth year had been reached. However, for the first two years, receipts from cattle would decline because more young stock would be needed to build up brood cow numbers.

Higher corn yields would increase receipts from hogs for the first five years of the soil improvement program. No hogs were assumed to be raised from the seventh year on because all corn would be needed for the expanded beef enterprise. Wheat sales increased about 40 percent during the period studied. A slight decline occurred in the first year of the program because of feeding more hogs.

Prices used in calculating receipts were as follows: beef for slaughter (average of steers and heifers) $24.00 per hundred pounds, after deducting hauling charges, cull cows $14.00 net per hundredweight, hogs $20.00 net per hundred pounds, and wheat $2.00 per bushel. Hog and wheat prices were averages received by Ohio farmers for the five year period 1951-55. Prices used for slaughter cattle were averages for animals grading good on the Chicago market for the period 1951-55.[11] Prices for cattle grading good were used because top level management and a better than average herd were assumed. Calves were assumed to be born during the early part of April, weaned from October 15 to November 15, and fed in dry lot until sold in July. Chicago prices also were used for cull cows. When adjustments are made for increases in the general price level, beef cattle prices also average about the same for the 10 year period 1946-55 as in the five year period 1951-55.

[11]No detailed fat cattle prices are available for markets in southeastern Ohio. However, prices reported by Shaudys and Sitterley for 1954 check closely with Chicago market quotations for comparable grades.

TABLE 6.—Calculated Cash Receipts for 500 Acre Beef Farm

Year	Beef*	Hogs	Wheat	Total
0†	$5596	$ 600	$ 804	$ 7000
1‡	4232	1920	772	6924
2	4984	1560	818	7362
3	5736	1240	858	7834
4	6348	1040	914	8302
5	7508	840	996	9344
6	8324	440	1046	9810
7	9076	0	1116	10192
8	9688	0	1116	10804
9	9892	0	1144	11036

*Includes slaughter animals; also cull cows amounting to about 15 percent of the number of breeding animals in the herd.

†Before soil improvement program was established.

‡Years 1-9 represent period of improvement.

Expenses—Annual expenses for the nine year period are shown in table 7, except for three major items. Charges for family labor and interest on capital will be discussed in detail later. Depreciation on buildings was figured in table 5. Heavy applications of lime and fertilizer accounted for most of the increased costs in table 7. Smaller lime applications would have reduced immediate costs, but they also would have delayed the time when net income would be maximized. Fertilizer costs were lower in the first year than later because none was used on timothy meadows.

During the first four years of the soil improvement program, annual cash expenses were about $2500 greater than before any changes were made. But from the fifth year on, annual expenses were about $2000 higher. More livestock increased feed costs $243 in the ninth year of the program. More hay increased machinery costs about $274. The assumption was made that no cash outlay would be needed for machine hire. However, some exchange of equipment with neighbors would be necessary to keep machinery costs down to the estimated values.

TABLE 7.—Estimated Cash Expenses for 500 Acre Beef Farm

Year	Lime	Fertilizer	Machinery‡	Feed	Seed	Repairs on buildings and fences	Taxes and Insurance	Hired labor	Miscellaneous§	Total
0*	$ 105	$ 285	$1375	$482	$375	$300	$457	$ 75	$220	$3674
1†	1470	1116	1407	580	402	300	457	75	220	6027
2	1470	1291	1460	592	402	300	477	90	240	6322
3	1470	1291	1517	609	402	300	495	100	265	6449
4	1374	1291	1537	630	402	300	513	110	285	6442
5	600	1291	1549	691	402	300	532	120	310	5795
6	600	1291	1589	693	402	300	540	130	325	5870
7	552	1291	1629	685	402	300	548	140	335	5882
8	552	1291	1649	720	402	300	552	150	340	5956
9	390	1291	1649	725	402	300	553	150	340	5800

*Before soil improvement program was established.

†Years 1-9 represent period of improvement.

‡Includes depreciation, obsolescence and repairs; also tractor fuel and oil.

§Includes small items such as telephone, electricity, veterinary and depreciation on bulls. Depreciation on cows accounted for in selling price. Marketing costs were deducted from the price of cattle before calculating gross receipts.

Distribution of labor should create no serious problems, except during the hay making season. At that time some additional labor was assumed to supplement the labor of a full-time operator and his family. In some cases this additional labor might be obtained by exchanging work with neighbors. In this study 75 hours of hired labor were figured to be needed before the soil improvement program began. But in the ninth year of the program, 150 hours of hired labor were estimated to be needed to make 135 tons of first cutting hay. Cost of this labor was figured at $1.00 an hour.

Net Income—Calculations in table 8 show why the first few years of a soil improvement program may be difficult to finance out of current farm earnings. Until about the fifth year of the program, net cash income will be less than before any changes were made. About seven years will be needed to increase hourly returns to labor because labor requirements increase as more crops and livestock are raised.

These calculations are based only on cash receipts. Inventory increases were omitted because they could not be withdrawn from the farm business, and at the same time used to produce more income later. Labor needs for crops were determined from average Ohio requirements adjusted for southeastern Ohio. Labor requirements for livestock were calculated from averages for the state as a whole.[12]

Annual returns were calculated two different ways to show whether they would be sufficient to finance the soil improvement program as it was established. One method omitted any interest charge. If a farmer owned all capital needed, no cash outlay would have to be made for interest payments. Consequently, returns to capital could be used to pay current expenses, if needed. The other method was based on paying an average interest charge of four percent on the valuation placed on land, buildings, machinery and livestock. Although borrowed capital usually costs more than this amount, capital owned usually returns somewhat less than four percent when deposited in banks and building and loan associations.

If $2500 plus the use of a house were used annually for family living, some off-farm income would be needed to finance the first four years of the program, even if all capital were owned and no interest charge were made for its use. If four percent interest were charged

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[12]Sitterley, J. H., Measures of Farm Work, Rate of Performance and Time Requirements for Common Farm Operations and Tasks. Department of Agricultural Economics and Rural Sociology, Ohio State University and Ohio Agricultural Experiment Station, Mimeograph Bulletin No. 221, October, 1950.

TABLE 8.—Calculated Net Income and Labor Requirements for 500 Acre Beef Farm

(Based only on cash receipts; inventory increases omitted)

Year	Return to labor and capital	Interest charge	Return to labor only	Return per hour of labor	Hours of labor required of farm family*
0†	$3326	$1584	$1742	$ .78	2223
1‡	897	1584	—687	—.30	2298
2	1040	1660	—620	—.26	2427
3	1385	1736	—351	—.14	2556
4	1860	1804	56	.02	2660
5	3549	1888	1661	.59	2807
6	3940	1924	2016	.70	2899
7	4310	1952	2358	.80§	2963
8	4848	1972	2876	.94	3046
9	5236	1976	3260	1.06	3068

*Includes miscellaneous labor used for building fences, marketing farm products, repairing fences, buildings, and machinery, etc.

†Before soil improvement program was established.

‡Years 1-9 represent period of improvement.

§A financial statement for the first six years (until annual receipts would be sufficient to pay labor and capital average rates or more) showed the following: total cash receipts, $49576; expenses including a payment of $.75 an hour for labor and four percent interest on capital, $59235; increase in capital invested, $8500; loss $1159.

against all capital used, considerably more off-farm income would be needed to finance the first six years of the program. Stated somewhat differently, if $2500 were used annually for family living, no payments on interest or principal could be made out of farm earnings before the fifth year.

A part-time job off the farm should provide enough additional income to finance the early stages of the soil improvement program, if no capital were borrowed. At that time labor requirements would be about 700 hours less than needed in the ninth year. If four percent interest were charged against capital, considerably more off-farm income would be needed for a few years to finance the program. However, it is doubtful whether a farmer could hold a full-time job and get all farm work done unless he received a large amount of help from his family.

From 1951-55 Ohio farm wage rates averaged about $.75 an hour plus the use of a house. If all labor were paid this amount and capital were allowed four percent interest, about seven years would be needed before cash receipts and increases in inventory would be sufficient to pay all previous costs of the soil improvement program. These calculations are based on producing 195[13] pounds of beef per acre of cropland and improved permanent pasture, 1951-55 production costs, and a price of $24.00 net per hundredweight for slaughter cattle.

If capital were borrowed, additional income would be needed to make repayment on principal. Since lending agencies usually require some repayment on loans each year, most farmers would have difficulty borrowing any sizable amount of money during the early stages of the program just described. Therefore, they might have to use a slow rate of improvement to keep additional expenditures to the minimum. Such a procedure, however, would reduce annual receipts below the calculations in this study, and delay the time when the program would yield the greatest income.

Preceding calculations gave no credit to possible income from woods. Over a period of time annual sales from timber might average about $1.00 an acre on the stump from the kind of forest land and care assumed in this study.[14] But harvestings would seldom be made annually from areas as small as 150 acres. Under these conditions several years might elapse before this source of income could be used to finance a soil improvement program. Even if profits from forest land had been credited to farm receipts, conclusions would not have changed significantly. On an annual basis, income from forest areas would represent only a small percentage of the total for the farm.

ADDITIONAL ECONOMIC CONSIDERATIONS

Income figures for the 500 acre farm were based on a yearly production of 195 pounds of beef per acre. Acreages used in calculating this production included only improved permanent pasture and cropland providing feed for the beef herd. Unimproved permanent pasture

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[13]This figure was determined by dividing the number of pounds of slaughter cattle and cull cows sold in the ninth year of the program by the number of acres of grain, hay and improved pasture fed to the beef enterprise in that year.

[14]This is about the return that most farmers are getting from the average farm woods in southeastern Ohio. Farm woods are often located on steep, stony slopes that produce a slow rate of timber growth. Also, a thin stand of desirable trees are often found on much of the land classified as forest.

was omitted because it consisted principally of briars, broom sedge, poverty grass and brush. This type of vegetation could not be improved because it was located on slopes too steep to lime, fertilize and mow with modern farm machinery.

To produce 195 pounds of beef per acre of cropland and improved permanent pasture the following acreages of crops would be needed for each brood cow in the herd: grain .6, hay and rotation pasture 1.4, improved permanent pasture 2.2, or a total of 4.2 acres. These figures include feed required by breeding bulls, calves and enough young cattle to replace about 15 percent of the old cows each year. If unimproved permanent pasture were included in the feed supply, about .9 acres more per cow would have to be added. This would reduce annual beef production to about 160 pounds per acre.[15]

Chart 1 shows the number of years required before the soil improvement program will pay for itself out of cash receipts and increases in inventory when different beef prices and levels of production are used. Expenses were calculated on the basis of 1951-55 production costs. They included a charge of $.75 an hour for family labor plus the use of a house and four percent interest on all capital used.

Two levels of beef production were studied. One was the 195 pound per acre level previously discussed. The other was 150 pounds. Consideration was given to this lower level because some poorer tracts of land may not give the crop yield increases assumed for the 500 acre farm. Also, average livestock management would produce less than 195 pounds of beef per acre of cropland and improved permanent pasture.

If annual production of beef is assumed to be 195 pounds per acre and slaughter cattle sales average $23.00 net per hundred pounds, about 10 years will be needed to finance the soil improvement program out of cash receipts and increases in inventory. A price of $24.00 per hundredweight will reduce the time required to seven years. If the average price of slaughter cattle were less than $21.00 per hundred pounds, farm earnings would not be great enough under these conditions to pay all costs of the soil improvement program. In calculating costs, all family labor was assumed to be paid $.75 an hour plus the use of a house and four percent interest was charged on all capital invested.

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[15]This production checks closely with the highest levels of efficiency shown in the following publication: Miller, Lewis R. and John H. Sitterley, A Study of the Commercial Beef Breeding Enterprise on Selected Farms in Southeastern Ohio in 1950. Department of Agricultural Economics and Rural Sociology, Ohio State University, Mimeograph Bulletin No. 239, March, 1953.

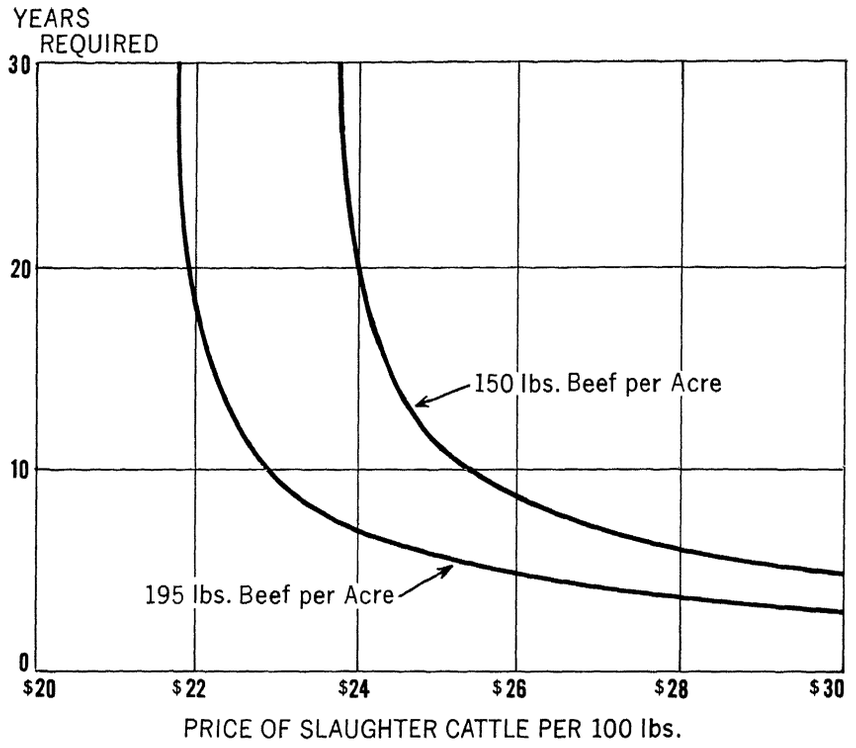

Chart I.—This shows the number years needed for the soil improvement program to pay for itself. Two levels of beef production were studied.

If production of beef averaged only 150 pounds per acre of cropland and improved permanent pasture, slaughter cattle would have to sell for about $25.50 net per hundred pounds to pay all costs within 10 years. A price of $28.00 per hundredweight would reduce the time needed to about six years. Farm earning would not pay all additional costs if the average price of slaughter cattle were below $23.00.

These figures may look somewhat discouraging, but calculations also show that if no soil improvement work were done, labor and capital could not be paid average rates unless slaughter cattle sold for more than $23.50 per hundred pounds. Therefore, the soil improvement program did more to increase volume of business than raise unit returns to labor and capital.

A soil improvement program can increase net income in two ways. One is by increasing the returns per unit of labor and capital. The other is by providing more hours of work and greater use of capital. Before any changes were made, hourly returns to labor were $.78 for 2223 hours based on a production level of about 110 pounds of beef per acre.[16] But in the ninth year of the soil improvement program, hourly returns to labor would be $.82 for 2705 hours at the 150 pound level of production. Under these conditions, most of the financial gains would come from increasing volume of business. With beef production at the 195 pound level hourly returns would be $1.06 for 3068 hours of labor. Financial gains in this case would result from higher returns per hour as well as greater use of labor.

Previous calculations do not apply to land that is too rough to produce corn from the standpoint of erosion control. Suppose permanent pasture, meadows and some small grain were the only crops that could be raised, and that young stock were sold as feeder calves weighing about 450 pounds because no corn would be available for fattening to slaughter weights. Under these conditions, about 750 acres of land were estimated to be needed to provide the same labor requirements as the 500 acre tract. This larger tract of land should support about three-fourths more brood cows and require about 30 percent more capital than the smaller acreage. From the ninth year on labor income should be about the same for each tract. But time required to finance the soil improvement program out of farm earnings on the 750 acres was calculated to be about twice the amount needed on the 500 acre farm because one-half more land improvements would have to be financed with about the same annual gross receipts. These relationships are based on a slaughter cattle price of $24.00 per hundred pounds and a feeder cattle price of $25.00.

Beef production could be increased slightly for the entire farm if some corn were harvested as silage. But not enough to change preceding conclusions regarding the length of time needed to finance the soil improvement program. If one ton of corn silage were consumed per feeder calf, only 43 tons would be needed in the ninth year of the program. This amount could be supplied from about 4.5 acres. If corn silage produced 125 pounds more beef per acre than grain alone, total beef production would increase only about 565 pounds. At $24.00 per hundred pounds, gross income would increase only about $135. Net income would be considerably less than this amount after paying the additional harvesting costs for labor and machinery and the annual cost of having a silo.

[16]Slaughter cattle prices used were $24.00 per hundred pounds.

The question might be asked how beef cattle can pay for a soil improvement program when cost of production studies often show losses for the beef enterprise. This apparent discrepancy can be explained in several ways. Cost of production studies are usually based on the practices used by **average** beef farmers. This study was based on above average practices which included high seasonal prices for cattle grading good, a minimum investment in machinery, fences and buildings, efficient use of labor, a well balanced pasture program, high crop yields, a 93 percent calf crop and no serious droughts.

In this study no values were assigned to specific crops in figuring costs of producing beef. Only actual expenses for the farm as a whole were used. This procedure placed a lower value on the cost of feed than used in most cost of production studies which use market prices for grain and hay. Market prices may often be too high for such crops as hay because an established outlet is not available for many farmers. Therefore, beef cattle are often kept to market crops that otherwise would produce little income.

Part-time farmers on small farms should be able to finance a major soil improvement program raising beef cattle easier than preceding figures indicate. Reasons why, include smaller investments in lime, fertilizer and additional livestock. Also a job in town often pays considerably more per hour than beef cattle.